

# Implementing Higher Education Partnerships: Enhancing Inquiry-Based Science Education at Multiple Levels

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# Working with Higher Education to fulfill Partnership Objectives

- Science Education in Higher Ed
  - College of Education
    - Science Methods/Content
    - Graduate Science Education
    - Professional development
  - College of Arts and Sciences
    - Content Classes
    - Graduate Science Education
    - Professional development
  - Diverse levels of cooperation/partnership between two elements
  - GLOBE Partnership is a great vehicle to improve cooperation!

# How Do I Involve Higher Education With GLOBE?

- Identify Science content needs of undergraduate and graduate Education majors.
- Identify ongoing professional development needs and programs based on campus
- Identify COE and CAS Department faculty who meet these needs.
- Get them together to talk about GLOBE and Earth System Science as a foundation for an **integrated science class** and an **environmental observations class** for undergraduates.
- Develop ties to standards
- Develop graduate classes and professional development programs that serve in-service teachers needs
- Train COE and CAS faculty in GLOBE

# GLOBE Training for Higher Education Faculty

- The “Hook” for both COE and CAS:
  - Science with “inquiry” focus
  - Hands-on laboratory experiences
  - Activities that combine content and pedagogy
  - Based on national standards
  - Meets objectives in pre-service education
  - Provides a focus for in-service professional development and outreach
  - Provides cooperative funding opportunities
  - Brings together diverse disciplines for outreach

# GLOBE Meets Objectives in Pre-Service Education

- Pre-service Objectives
  - Basic science literacy
  - Science “across the curriculum”
  - Develop Earth Systems perception
  - Hands-on observation skills
  - Inquiry-based perspective
  - Introduction to Performance-based Standards
  - Introduction to CAS and COE faculty as future mentors and resource contacts

# Environmental Observations

## GEOL 1123 + lab

- Course laboratory designed with Science Education faculty partner from College of Education
- Early Childhood Education majors are advised to take the class
- Fulfills Core requirement for Science + lab course
- 4 hours credit (3 hours class; 2 hours lab)
- As a “core” class, is open to all disciplines

# Earth Systems Perspective

## ■ **Course Objectives:**

- To understand the earth as a system in which the hydrosphere, biosphere, lithosphere, and atmosphere interact to create our environment.
- During this course you will learn to:
  - Understand the relationships among the earth's four spheres and how they affect one another
  - Make environmental observations using sound scientific protocols, scientific inquiry methods and perspectives
  - Plan and implement standards-based student inquiry projects concerning the Earth System
  - Use online visualization technology to map, graph, and analyze global environmental data

# Classroom Infusion Project

- You will work alone or with a group to design a bulletin board or other visual display for your classroom concerning
  - the Earth System
  - GLOBE observations protocols, or
  - GLOBE learning activities

This project can be designed to teach an Earth System science concept, or to promote observational skills. This will be presented to the class.



# Student Inquiry Project

- You will design a "student inquiry project" using
  - Data you gather using GLOBE protocols learned in lab
  - GLOBE data from the GLOBE data archive
  - Other GLOBE resource materials that would enable you to address performance standards for your grade level
- You will be provided with a project format to follow.
- You will be provided with the appropriate performance standards for your grade level.
- You will submit the project design for approval/revision
- You will submit the research results in a brief report.

# Students will recognize the effects of pollution on the environment (3<sup>rd</sup> grade Georgia Performance Standard for Life Science #2): Acid Rain

- Hypothesis: Acid rain will damage plant leaves and increase soil pH, killing plants.

Grade-level appropriate?

Discuss experimental design problems concerning soil pH

- Revised hypothesis: Acid rain will damage plant leaves and slow plant growth.

# Experimental Design:

- 5 identical plants
- 5 concentrations of water/vinegar in spray bottles (pure water; 25% vinegar; 50% vinegar; 75% vinegar; 100% vinegar)
- Spray twice a week for four weeks, until leaves are covered with water and spray drips off of leaves, soaking soil surface.
- Photograph plants once a week.
- Chart plant growth (height)
- Report using designated format

Students will differentiate between the states of water and how they relate to the water cycle and weather. (4<sup>th</sup> grade Georgia Performance Standard for Earth Science #3): **Condensation**

- Observation: When I shower in the winter, water condenses on the windows in the bathroom. The bedroom windows are dry.
- Hypothesis: In both rooms, the air near the windows is colder than the air in the rest of the room because of cold air outside, but the humidity reaches 100% inside the bathroom while the shower is on.

# Experimental Design:

- Measure outside temperature
- Measure inside temperature in both rooms
- Measure inside relative humidity in both rooms
- Turn on shower and measure relative humidity at 4-minute intervals until condensation begins on windows.
- Chart results
- Report using designated format

# Current Events Collection

- Each week, beginning with week one, you will
  - find an article about the environment from a **current, printed** newspaper or magazine
  - write a brief (2-paragraph) synopsis of the article, highlighting its Earth Systems connections. The articles and the synopses will be pasted into a notebook for submission. Selected articles will be discussed in class.

# Laboratory Journal

- **Journal:** You will keep a weekly reflective journal in which you will
  - Record introductory science content notes concerning lab activities
  - Record observations in these content areas that you make **outside of class**
  - Ask and record questions and hypotheses you develop concerning your observations
  - Your journal should be a source of ideas for your student inquiry project.



# Journal Observations Example

- Today is my 12<sup>th</sup> and final journal. Tonight's observation is quite an interesting one. It's about 11:00 p.m. and I am at a campout and it is very cold. The temperature is about thirty five degrees or so. Me and a couple of my buddies got the great idea of starting a fire. Well my question is "what is the temperature change when you are five feet away from the fire (like the area where everyone was standing), opposed to being 10 feet from the fire? Well I had a thermometer in my truck and measured the temperature 5 feet from the fire and 10 feet from the fire. The temperature 5 feet from the fire was eighty-three degrees and the temperature 10 feet from the fire was a shocking fifty-three degrees! Wow, that's over a 30 degree temperature change, just in a matter of five feet. And by the way, my buddies were not aware of my experiment, I'm sure I would have gotten an earful.



# GLOBE in In-service Education

## ■ In-service Objectives

- Basic science literacy
- Develop Earth Systems perception
- Hands-on observation skills
- Inquiry-based perspective
- Introduction to Performance-based Standards
- Introduction to A&S and COE faculty as future mentors and resource contacts
- Recertification
- Content-area update
- Develop "Across-the-Curriculum" programs
- Electives

# Course Objective

## Earth Science for Teachers

- To introduce Earth System Science topics across all 6<sup>th</sup>-grade Earth Science Georgia Performance Standards' co-requisite "content" and "characteristics of science" standards;
- To provide resources for Middle-grades Earth Science Teachers to use in teaching Earth Science;
- To develop hands-on data-gathering and analysis experience using scientific protocols and tools;
- To introduce the GLOBE Environmental Education Program and certify teachers.

# Learning Goals- Content

- Explore current and historical scientific views of the Universe and the solar system
- Understand the effects of the relative positions of the earth, moon and sun.
- Recognize the significant role of water in earth processes.
- Understand how the distribution of land and oceans affects climate and weather.
- Investigate the scientific view of how the earth's surface is formed.
- Describe various sources of energy and with their uses and conservation.

# Learning Goals- Characteristics of Science

- Students will use **standard safety practices** for all classroom laboratory and field investigations.
- Students will use **computation and estimation** skills necessary for analyzing data and following scientific explanations.
- Students will **use tools and instruments** for observing, measuring, and manipulating equipment and materials in scientific activities.
- Students will **use the ideas of system, model, change, and scale** in exploring scientific and technological matters.
- Students will **communicate scientific ideas and activities clearly.**
- Students will investigate the features of the process of **scientific inquiry.**

# Course Format

- WEEK 1: Content lectures, with accompanying exercises from the text.
- WEEK 2: Online activities and exercises from the text; preparation of project.
- WEEK 3: Hands-on Laboratory Activities (primarily GLOBE Program activities, leading to GLOBE Certification for all participants).
- WEEK 4: Project preparation and presentation

# Current Events Collection

- Each week, beginning with week one, you will
  - find an article about the environment from a **current, printed** newspaper or magazine
  - write a brief (2-paragraph) synopsis of the article, highlighting its Earth Systems connections. The articles and the synopses, will be pasted into a notebook for submission.

# Project Presentation

- Your project will be to select a “sample task” for implementation in your classroom
  - Tie it to a specific Performance Standard
  - Explain how it will help students achieve the learning goals of the Standard, or
  - How it will help you to assess student learning.
- During the second week of class, you will be visiting a variety of resource sites from which to choose the tasks (including <http://www.globe.gov/tctg/conceptsearch.jsp>)

# Lab Assessment Journal

- For each lab during the third week of class, you will comment on whether or not the protocol or learning activity is
  - Grade-level appropriate
  - Can be a jumping-off point for extended inquiry (such as a science project or class project)
  - Fulfills a particular Georgia Performance Standard effectively



# ANALYSIS OF GLOBE ACTIVITIES

- I really enjoyed the activities that were performed on Wednesday. I think calibrating the instruments is not only an activity that students would have fun with, but it is also an activity that is necessary for students to understand the importance of.
- My students would LOVE moving to a site where they determined observations such as temperature, pH, and turbidity of water. It isn't often that students are allowed to perform hands-on activities outside of the classroom, and I believe they would appreciate the opportunity.

# ANALYSIS OF GLOBE ACTIVITIES

- My students would love looking at other school's data and converting these into charts and graphs. This is also a skill that students need to sharpen. They would love knowing that their experiments were being used in some way. They would also enjoy seeing that other students were performing the same experiments they were performing. GLOBE makes it easier for teachers to answer the never ending questions, "Why are we studying this?" or "When will we ever use this?"

# Integrated Science

- State mandated that by Fall 2007, all Early Childhood Education majors take two “integrated science” courses tied to state performance standards
- One course will cover Life/Earth Sciences
- Second course will cover Physical Sciences
- Both courses will have a laboratory element

# Integrated Science

- Another opportunity to infuse GLOBE protocols and learning activities
- Courses under development now
- Opportunity to enhance “across the curriculum” and inquiry approaches for K-5 teachers.
- Earth and Life Sciences

# Class Format

- Two 1-hour lecture sessions per week
- One two-hour laboratory session per week
  - Pre-lab preparation focused on guided inquiry
  - Tie together Life and Earth Sciences through ecosystems – using GLOBE soils, hydrology, atmosphere, land cover, and phenology protocols and learning activities
  - Small group activities will include sampling design; hands-on observations outside; comparison of results; presentation

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- Get them together to talk about GLOBE and Earth System Science as a foundation for an **integrated science class** and an **environmental observations class** for undergraduates.
- Develop ties to standards
- Develop graduate classes and professional development programs that serve in-service teachers needs (write a grant together!)
- Train COE and A&S faculty in GLOBE

# Outcomes

- True partnership among faculty in different Colleges involved in teacher education
- Mentoring relationship between faculty and teachers
- Access to resources beyond GLOBE partnership
- e.g. AmericaView

# AmericaView

- The University of West Georgia is working with local districts to develop environmental change detection data sets based on satellite imagery, to enhance Earth Science, Life Science, Biology and Environmental Science curricula at Middle and High School levels. Satellite imagery is being provided by the AmericaView program funding that supports GeorgiaView.



# AmericaView

- A non-profit educational consortium active in 30 states
- Goal is to promote applications of satellite imagery to addressing our nation's problems, including environmental change.
- Thirty StateView organizations are also involved in educational outreach to K-12 teachers and students to bring satellite imagery into classrooms.
- **Earth Observations Day**, October 19<sup>th</sup>, 2007, during Earth Science week
- <http://www.americaview.org>
- [http://www.americaview.org/AGI\\_Flier.pdf](http://www.americaview.org/AGI_Flier.pdf)

# Earth Observation Day

- **K-16 education and outreach focused on:**
  - **developing a focused set of activities that target specific standards and learning outcomes in the science and geography disciplines**
  - **developing interdisciplinary activities designed to connect remote sensing to mathematics, social studies, and creative disciplines including writing and the arts.**
  - **supporting local, regional and global remote sensing activities during Earth Observation Day**



## National Consortium For Remote Sensing Education, Research, and Applications Delivering National Satellite Resources to Meet State Needs

Distribution of StateView Programs  
as of January 2007

